



Industry, Energy and Technology

Mines

**GEOCHEMICAL DATA FROM VOLCANO-SEDIMENTARY
ROCKS ASSOCIATED WITH VMS-STYLE MASSIVE
SULPHIDE OCCURRENCES IN THE KETTLE POND
FORMATION, GLOVER ISLAND, WESTERN
NEWFOUNDLAND (NTS MAP AREAS 12A/12 AND 13)**

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Open File 012A/1900



St. John's, Newfoundland
February, 2023

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Recommended citation:

Conliffe, J.

2023: Geochemical data from volcano-sedimentary rocks associated with VMS-style massive sulphide occurrences in the Kettle Pond Formation, Glover Island, western Newfoundland (NTS map areas 12A/12 and 13). Government of Newfoundland and Labrador, Department of Industry, Energy and Technology, Geological Survey, Open File 012A/1900, 8 pages.

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SUMMARY

This open file release includes litho-geochemical data collected on drillcore and outcrop samples from Glover Island in western Newfoundland (NTS map areas 12A/12 and 13). These samples were collected from the Kettle Pond Formation on Glover Island, during fieldwork in 2019 and 2021. The Kettle Pond Formation is host to a number of known VMS-style massive sulphide occurrences, and this work formed part of a multi-year project investigating the geology and mineral potential of the Glover Island and Grand Lake areas.

Whole-rock geochemistry results are included for 101 samples, including 36 outcrop samples, 15 samples of massive to semi-massive sulphide boulders, and 50 drillcore samples. Drillcore samples were collected from historical drillcore located at the Government of Newfoundland and Labrador Core Storage facilities in Pasadena and Springdale. Interpretation of the litho-geochemical data, as well as information on the regional geological setting and descriptions of massive sulphide occurrences in the study area are found in Conliffe (2022).

NOTES ON THE DATABASE

This database includes the results of whole-rock major-element, trace-element and rare-earth-element (REE) analyses of 101 samples. Also included are the sample location data and brief sample descriptions. The location data for samples are presented in Appendix A, with locations reported as Universal Transverse Mercator (UTM) eastings and northings (zone 21, NAD27). The data are available in digital format (*i.e.*, *.csv comma-separated values files) in Appendices A to C.

All samples selected for geochemical analysis were prepared at the Geological Survey of Newfoundland and Labrador's (GSNL) geochemical laboratory in St. John's. Samples were milled using ceramic mills. Most analyses were carried out at the GSNL geochemical laboratory and analytical methods are described in Finch *et al.* (2018) and summarized in Table 1. Additional analyses (for trace elements including Au and Hg) of selected samples were conducted by Bureau Veritas and Actlabs.

Major-element compositions (plus Ba, Be, Cr, Sc and Zr) were analyzed by ICP-OES methods, following lithium tetraborate and metaborate fusion. REE and selected trace elements were determined by ICP-MS analysis following an identical sample digestion procedure, whereas other trace elements (As, Cd, Co, Cu, Li, Mo, Ni, Pb, Rb, S, V and Zn) were analyzed by ICP-OES after total 4-acid digestion. Volatiles are represented as loss-on-ignition (LOI) at 1000°C, which represents the breakdown of all minerals and release of all

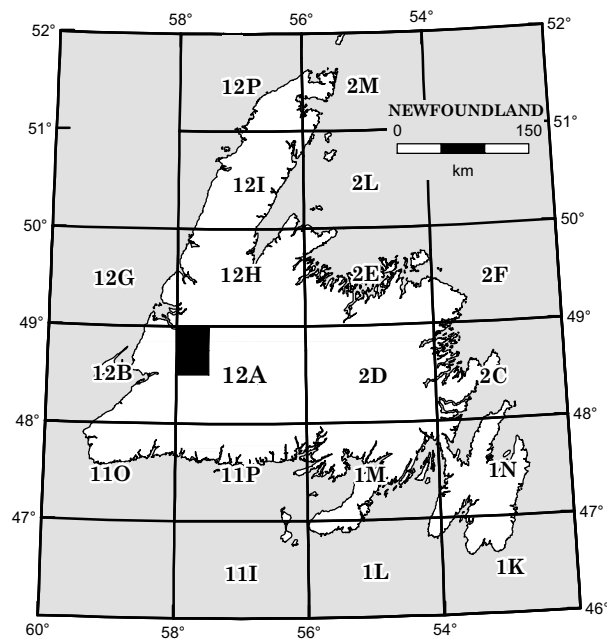


Figure 1. Location map of study area in western Newfoundland.

volatiles. The ferrous-iron content (FeO) of silicate rocks is determined by the Wilson Method (Wilson, 1960), as outlined by Finch *et al.* (2018). For silver analysis, 0.5 g of sample powder was weighed into a 15 ml digestion tube with 2 ml of concentrated nitric acid, and digested for two hours. The digested sample was analyzed by ICP-OES (Finch *et al.*, 2018). Thirteen samples were sent for Hg analysis, which was conducted by Actlabs using the aqua regia leach and Cold Vapour Atomic Absorption Spectrophotometry (CV-AAS).

Thirty-nine samples were also selected for analyses for trace elements including Au, Cd, Sb and As. These were conducted by Maxxam Analytics (now Bureau Veritas) using Instrumental Neutron Activation Analysis (INAA), and results are presented in Appendix A. Twenty-one of the 27 elements analysed by INAA are duplicates of elements analyzed by different methods at the GSNL geochemical laboratory. Although the detection limit varies between analytical methods, these data can be used to evaluate inter-laboratory precision. To prevent confusion, duplicate elements that have been analysed by INAA have been assigned the suffix `_INA` (*e.g.*, `As_INA`, `Ba_INA`, *etc.*).

Major elements are reported in weight percent (wt. pct), and minor and trace elements are reported in parts per million (ppm), except gold (Au), which is reported in parts per billion (ppb). A negative number indicates the concentration of the specific element in the sample was below the detection limit (*e.g.*, -0.01 indicates the measured value was below the detection limit of 0.01). Some samples analyzed by INAA have elevated detection limits due to high Sb, Br or Au contents. Detection limits are listed for each element in the .csv files. The code -99 indicates the sample was not analyzed for that element.

Mg# was determined by the formula: $Mg\# = (MgO/40.312)/((MgO/40.312)+(FeO/71.847))*100$. Alteration indices were calculated using major-element geochemistry and include the Ishikawa index ($AI = 100*(MgO+K_2O)/(MgO+K_2O+CaO+Na_2O)$; Ishikawa *et al.*, 1976) and the chlorite–carbonate–pyrite index values ($CCPI = 100*(MgO+FeO)/(MgO+FeO+K_2O+Na_2O)$; Large *et al.*, 2001).

A selection of reference standards that were analyzed in 2019 and 2020 are included at a frequency of one in 20. The raw, unprocessed data from standards that were run during analysis in 2019 and 2021 is included in Appendix B, and these data can be used by the reader to assess accuracy and precision. Analytical duplicates were also inserted at a frequency of one in 20, with the duplicate selected at random. For duplicates the variation between original and duplicate values was calculated in Appendix C using the following equation: $\%_difference = [(OriginalValue - Lab\ Split\ Value)/Original\ Value] * 100$.

ACKNOWLEDGMENTS

Sample preparation and geochemical analyses were carried out under the supervision of Chris Finch of the GSNL Geochemical Laboratory. Special thanks go to David Drover and Erin Butler for their able assistance in the field. William Oldford (Mines Branch) is thanked for access to drill-core. The Newfoundland and Labrador Department of Fisheries and Land Resources provided a scientific permit to collect samples in the study area. Pauline Honarvar provided a helpful review of an early draft of this file.

Table 1. Analytical methods for geochemical analyses

Analysis	Analytical Method	Preparation/Digestion
SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , MgO, CaO, Na ₂ O, K ₂ O, TiO ₂ , MnO, P ₂ O ₅ , Ba, Be, Cr, Sc, Zr	Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)	50-50 Lithium Tetraborate Lithium Metaborate Fusion
FeO	Titration	None
LOI	Gravimetric (Grav) at 1000°C	None
As, Cd, Co, Cu, Li, Mo, Ni, Pb, Rb, S, V, Zn	Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)	Hf-HCl-HNO ₃ -HClO ₄ (4-acid total digestion)
Bi, Ce, Cs, Dy, Er, Eu, Ga, Gd, Ge, Hf, Ho, La, Lu, Nb, Nd, Pr, Sm, Sn, Sr, Ta, Tb, Th, Ti, Tm, U, W, Y, Yb	Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	50-50 Lithium Tetraborate Lithium Metaborate Fusion
As, Au, Ba, Br, Ce, Co, Cr, Cs, Eu, Fe, Hf, La, Lu, Mo, Na, Rb, Sc, Se, Sm, Ta, Tb, Th, U, W, Yb, Zr	Instrumental Neutron Activation Analysis (INAA)	Irradiation
Ag	Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)	HNO ₃ digestion
Hg	Cold Vapour Atomic Absorption Spectrophotometry (CV-AAS)	Aqua regia

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APPENDICES

Appendices A–C are available as digital comma-separated files (.csv) through [this link](#).

APPENDIX A: Major-element and Trace-element Data

APPENDIX B: Major-element and Trace-element Data for Standards

APPENDIX C: Major-element and Trace-element Data for Duplicates